



Climatic models to predict occurrence of Fusarium toxins in wheat and maize

Author(s): Schaafsma AW, Hooker DC
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Abstract:

Although forecasting Fusarium infections have useful implications, it may be argued that forecasting Fusarium toxins is more useful to help reduce their entry into the food chain. Several disease incidence models have been commercialized for wheat, but only one toxin prediction model from Ontario, Canada, "DONcast", has been validated extensively and commercialized to date for wheat, and another has been proposed for maize. In the development of these predictive tools, the variation in toxin levels associated with year and agronomic effects was estimated from simple linear models using wheat and maize samples taken from farm fields. In wheat, environment effects accounted for 48% of the variation in deoxynivalenol (DON) across all fields, followed by variety (27%), and previous crop (14 to 28%). In maize, hybrid accounted for 25% of the variation of either DON or fumonisin, followed by environment (12%), and when combined 42% of the variability was accounted for. The robust site-specific, DON forecast model accounted for up to 80% of the variation in DON, and has been used commercially for 5 years in Canada. Forecasting DON and fumonisins in maize is more difficult, because of its greater exposure to infection, the role of wounding in infection, the more important role of hybrid susceptibility, and the vast array of uncharacterized hybrids available in the marketplace. Nevertheless, using data collected from controlled experiments conducted in Argentina and the Philippines, a model was developed to predict fumonisin concentration using insect damage and weather variables, accounting for 82% of the variability of fumonisins. Using mycotoxins as a measure of disease outcome, as opposed to disease symptoms, offers a more robust prediction of mycotoxin risk, and it accounts for mycotoxin accumulation that occurs frequently in the absence of any change in Fusarium symptoms.

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Resource Description

Exposure :

weather or climate related pathway by which climate change affects health

Food/Water Quality

Food/Water Quality: Biotoxin/Algal Bloom

Geographic Feature:

resource focuses on specific type of geography

None or Unspecified

Climate Change and Human Health Literature Portal

Geographic Location:

resource focuses on specific location

Non-United States

Non-United States: Asia, Central/South America, Non-U.S. North America

Asian Region/Country: Other Asian Country

Other Asian Country: Philippines

Health Impact:

specification of health effect or disease related to climate change exposure

Infectious Disease

Infectious Disease: Foodborne/Waterborne Disease

Foodborne/Waterborne Disease (other): Fusarium infections

Mitigation/Adaptation:

mitigation or adaptation strategy is a focus of resource

Adaptation

Model/Methodology:

type of model used or methodology development is a focus of resource

Exposure Change Prediction

Resource Type:

format or standard characteristic of resource

Review

Timescale:

time period studied

Time Scale Unspecified

Vulnerability/Impact Assessment:

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content